

WHAT IS CLAIMED IS:

1. A method for evaluating a photo mask
comprising:

5 preparing a photo mask including a unit drawing
pattern;

finding a dimensional variation relating to the
photo mask, the dimensional variation including first
and second dimensional variations, the first
dimensional variation occurring due to a positional
10 displacement and size mismatch of the unit drawing
pattern in the photo mask and the second dimensional
variation occurring due to etching and development
relating to a manufacturing of the photo mask;

estimating a deteriorated amount of an exposure
15 latitude occurring due to the dimensional variation of
the photo mask using the dimensional variation and a
degree of influence of the dimensional variation for
the exposure latitude; and

judging quality of the photo mask by comparing the
20 deteriorated amount of the exposure latitude and an
allowable deteriorated amount of the exposure latitude.

2. A method for evaluating a photo mask according
to claim 1,

wherein finding the dimensional variation relating
25 to the photo mask includes finding a third dimensional
variation of the photo mask caused by a positional
variation between deflection areas, the positional

variation between the deflection areas being arisen by movement of a stage of an exposure equipment: and

estimating the deteriorated amount of the exposure latitude is performed by using the first, second and
5 third dimensional variations and a degree of influence of the dimensional variation relating to the photo mask for the exposure latitude.

3. A method for evaluating a photo mask according to claim 1,

10 wherein finding the dimensional variation relating to the photo mask includes measuring a pattern on the photo mask, the pattern not extending across a boundary between deflection areas, the deflection areas being arisen by movement of a stage of an exposure equipment.

15 4. A method for evaluating a photo mask according to claim 1,

wherein a dimensional variation of a checking photo mask is substituted for the first dimensional variation, the dimensional variation of the checking
20 photo mask is previously obtained when an exposure equipment used for manufacturing the photo mask is checked with the checking photo mask, and the dimensional variation of the checking photo mask occurs due to a positional displacement and size mismatch of a
25 unit drawing pattern in the checking photo mask.

5. A method for evaluating photo mask according to claim 2,

wherein a dimensional variation of a checking photo mask is substituted for the first dimensional variation, the dimensional variation of the checking photo mask is previously obtained when an exposure equipment used for manufacturing the photo mask is checked with the checking photo mask, and the dimensional variation of the checking photo mask occurs due to a positional displacement and size mismatch of a unit drawing pattern in the checking photo mask.

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10 6. A method for evaluating photo mask according to claim 3,

 wherein a dimensional variation of a checking photo mask is substituted for the first dimensional variation, the dimensional variation of the checking photo mask is previously obtained when an exposure equipment used for manufacturing the photo mask is checked with the checking photo mask, and the dimensional variation of the checking photo mask occurs due to a positional displacement and size mismatch of a unit drawing pattern in the checking photo mask.

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20 7. A method for evaluating photo mask according to claim 1,

 wherein the degree of influence of the first dimensional variation for the exposure latitude is estimated using a function with variables having the positional displacement of the unit drawing pattern and variation of the size mismatch of the unit drawing

pattern.

8. A method for evaluating photo mask according to claim 2,

5 dimensional variation for the exposure latitude is estimated using a function with variables having the positional displacement of the unit drawing pattern and variation of the size mismatch of the unit drawing pattern.

10 9. A method for evaluating photo mask according to claim 3,

15 dimensional variation for the exposure latitude is estimated using a function with variables having the positional displacement of the unit drawing pattern and variation of the size mismatch of the unit drawing pattern.

10. A method for evaluating photo mask according to claim 7,

20 wherein the function is a function with a variable having a ratio of (the variation of the size mismatch of the unit drawing pattern) / (the variation of the positional displacement of the unit drawing pattern) as a variable.

11. A method for evaluating photo mask according to claim 8,

25 wherein the function is a function with a variable having a ratio of (the variation of the size mismatch of the unit drawing pattern) / (the variation of the

positional displacement of the unit drawing pattern) as a variable.

12. A method for evaluating photo mask according to claim 9,

5 wherein the function is a function with a variable having a ratio of (the variation of the size mismatch of the unit drawing pattern) / (the variation of the positional displacement of the unit drawing pattern) as a variable.

10 13. A method for evaluating a photo mask according to claim 10,

 wherein the function is found by a Monte Carlo simulation.

15 14. A method for evaluating a photo mask according to claim 11,

 wherein the function is found by a Monte Carlo simulation.

 15. A method for evaluating a photo mask according to claim 12,

20 wherein the function is found by a Monte Carlo simulation.

 16. A method for manufacturing a semiconductor device comprising:

 selecting a good photo mask by judging quality of
25 a photo mask using a photo mask evaluating method, the photo mask evaluating method comprising preparing a photo mask including a unit drawing pattern; finding a

dimensional variation relating to the photo mask, the dimensional variation including first and second dimensional variations, the first dimensional variation occurring due to a positional displacement and size mismatch of the unit drawing pattern in the photo mask and the second dimensional variation occurring due to etching and development relating to a manufacturing of the photo mask; estimating a deteriorated amount of an exposure latitude occurring due to the dimensional variation of the photo mask using the dimensional variation and a degree of influence of the dimensional variation for the exposure latitude; and judging quality of the photo mask by comparing the deteriorated amount of the exposure latitude and an allowable deteriorated amount of the exposure latitude, and performing a photolithography process using the selected good photo mask.

17. A method for manufacturing a semiconductor device according to claim 16, wherein finding the dimensional variation relating to the photo mask includes finding a third dimensional variation of the photo mask caused by a positional variation between deflection areas, the positional variation between deflection areas being arisen by movement of a stage of an exposure equipment: and estimating the deteriorated amount of the exposure latitude is performed by using the first, second and

third dimensional variations and a degree of influence of the dimensional variation relating to the photo mask for the exposure latitude.

18. A method for manufacturing a semiconductor
5 device according to claim 16,

wherein finding the dimensional variation relating to the photo mask includes measuring a pattern on the photo mask not extending across a boundary between deflection areas, the deflection areas being arisen by
10 movement of a stage of an exposure equipment.

19. A method for manufacturing a semiconductor device according to claim 16,

wherein a dimensional variation of a checking photo mask is substituted for the first dimensional
15 variation, the dimensional variation of the checking photo mask is previously obtained when an exposure equipment used for manufacturing the photo mask is checked with the checking photo mask, and the dimensional variation of the checking photo mask occurs
20 due to a positional displacement and size mismatch of a unit drawing pattern in the checking photo mask.

20. A method for manufacturing a semiconductor device according to claim 17,

wherein a dimensional variation of a checking
25 photo mask is substituted for the first dimensional variation, the dimensional variation of the checking photo mask is previously obtained when an exposure

equipment used for manufacturing the photo mask is
checked with the checking photo mask, and the
dimensional variation of the checking photo mask occurs
due to a positional displacement and size mismatch of a
5 unit drawing pattern in the checking photo mask.